Research on Inferential Process in L2 Reading : limitations and possibilities

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0. Introduction

Text comprehension requires comprehenders not only to decode what is explicitly described in a text but also to connect the linguistic information and what they know about the world by making inferences. Since a text is never fully explicit, readers must be able to make inferences and fill in conceptual gaps. Let us consider the following example from Rumelhart and Ortony (1977) for a better understanding of this issue.

(1) Mary heard the ice cream man coming.
She remembered her pocket money.
She rushed into the house.

In order to understand the causal relation described in (1), the readers need to make such assumptions as the following against background knowledge regarding the act of buying ice cream from an ice cream man: Mary hurried into the house to fetch her pocket money with which she can buy an ice cream. This story would never be fully coherent to the reader unless s / he has enough general knowledge or effective cognitive skills to link various events described in the story into a whole.

Such a text level process as making inferences has been extensively identified as one of the factors which cause reading difficulty as well as direct factors such as lack of vocabulary and failure in syntactic or semantic analyses of sentences (cf. Kintsch & van Dijk 1978). Oakhill (1984) has also pointed out that a major distinguishing characteristic of skilled readers is that they are good at making inference.

Over the last few decades, a considerable number of studies have been devoted to the study of inference process in such fields as cognitive psychology and educational psychology in order to answer the questions about inference generation such as what type of inference is most or least easily generated (cf. Vonk and Noodman 1990, Graesser & Bower 1990). In L2 reading, however, only a few attempts have so far been made at researching of inference process as one of L2 reading constructs, largely due to the pedagogically orientated nature of earlier L2 reading research.

In recent times, however, serious research attention has been gradually attracted by the exploration of L2 reading constructs such as 'inference process'. Consequently there is an emerging need for new research paradigms which have a well-established theoretical ground from which generalizations can be made about L2 reading process and which also will clarify the unique aspects of L2 inference process. Although basing its theoretical ground on principles derived from L1 research is a logical point of departure in establishing a new field of inquiry, just extrapolating L1 perspectives to L2 research without due regard for the unique demands posed by L2 reading will result in confounding elements, inadequate conceptualizations and less ideal practice. Further in-depth analyses are required to enrich our understanding of the complex interacting

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mechanisms that govern the effectiveness of L2 reading.

In the subsequent section, I will briefly review current research development in L1 / L2 reading with a heavy focus on inference process, in order to identify essential dimensions to L2 inference research.

1. Inference Study in Reading

1.0. Treatment in Cognitive Psychology

In L1 comprehension studies, the term 'inference' is often used to refer to knowledge-based inferences drawn during text comprehension when world knowledge structures such as schematic knowledge representation is activated, and the content of these structures is incorporated into the constructed meaning of the text (cf. Graesser & Kreuz 1994).

Serious research attention has been paid to the attempt to identify what type of inferences is spontaneously made during reading (namely on-line generation) and what type is not, in such a field as cognitive psychology or discourse process. On-line inference generation is contrasted with off-line generation which is not spontaneously carried out but induced or even forced by such retrieval tasks as comprehension questions.

The current research has shown considerable findings that defy the conclusion prevalent in the earlier literature that the inference type which is always made in the on-line manner is coherence-establishing inference which is necessary for comprehension (i.e. pronominal resolution and causal relation). That is, the comprehenders can also generate, in the on-line manner, even the type of inference which is assumed to be optionally made and elaborate text representation (i.e. main theme and the author's intent), only when the appropriate conditions are satisfied in terms of readers' background knowledge, the purpose of reading and the text type (cf. Graesser & Bower 1990, Vonk & Noodman 1990).

The focus on individual differences among readers is also a growing trend in the study of inference processes, stemming, in large part, from landmark findings on high correlation between working-memory capacity and inference ability (cf. Singer & Ritchot 1996, Dixon etal. 1988, Whitney et al. 1991).

1.1. Treatment in Educational Psychology

L1 reading research in educational psychology has also been devoted to investigating inference process primarily from the perspective of acquisition of cognitive skills and instruction effects. Considerable studies have demonstrated that children at all grade levels can successfully generate inferences and that inferential ability improves with age, although there are some difficult inferences to make (cf. Casteel & Simpson 1991, Casteel 1993). The effectiveness of inference training has been also extensively reported in the literature (Hansen 1981, Yuil & Oakhill 1988). Major research attention has been paid to such issues as identification of the condition where inferences are most or least easily generated.

1.2. Inference in L2 Reading

As mentioned earlier, traditional L2 reading research has stemmed from a pedagogically oriented effort to enhance classroom teaching, placing a heavy emphasis on seeking a better reading instruction. Only in the last decade, the exploration of L2 reading constructs has received serious research attention from L2 reading researchers. Consequently there have been only a few attempts made at the L2 reading research with a main focus on inferential process, though the significant role of inferential skill in reading has been stressed in the literature as one of the most distingushing conditions of being a good reader (cf. Carrell 1984, Horiba 1993).

Although there is scanty work done on investigating L2 reading process with heavy focus on inferential process as a L2 reading construct, numerous studies have been carried out on inference from the perspective of testing, to demonstrate how costly answering inferential questions is by comparing them with performance in response

to literal questions (cf. Takahashi 1983, Yamashita & Otagaki 1997). Testing-oriented L2 reading studies thus suggested heavy metacognitive demand is required for answering inference questions, but a simple comparison of the performance of two question types only provides a limited view of the potential intricacies of other interactions such as methodological issues. The multiple choice question format, for example, yields different results from what its free-response counterpart does because it fails to assess spontaneous inference-generation, and rather induces or even forces inference generation due to plenty of clues provided by the distractors.

MacCagg (1984) and Chikalanga (1991) are two of the few works which concentrated on investigating inference process in L2 reading and demonstrated high correlation between L2 inferential ability and other factors such as L2 linguistic knowledge, background knowledge and age-related metacognitive development. However, no direct evidence has been provided for the question of L1 reading transferability and L2 threshold issues.

The effect of reading instruction with heavy emphasis on inference training has been also investigated (Shimada 1992, Collins and Tajika 1996) and proficiency-related difference of effectiveness was also pointed out. In Collins and Tajika (1996), for example, a significant effect of the training has not been seen and even negative effect was shown on less advanced learners' comprehension, despite the prevailing assumption that inference training is one of the most effective reading instructions.

Although considerable works have been carried out to show L2 inferential behavior for various research purposes, it seems that there is no consensus on exactly what process the term 'inference' refers to and this term has been inconsistently used in L2 reading research[1].

Thus, the brief overview of the recent L1 / L2 inference research allows me to point out some useful insights and problems for future L2 inference research. In the subsequent sections, I would like to propose there are mainly five essential dimensions to L2 inference research and discuss how these dimensions can be incorporated in the research.[1]

2. Fundamental Dimensions to L2 Inference Research

It is generally understood that L2 reading involves mainly two levels: a level for processing L2 linguistic properties which are language specific; and the other level for general cognitive skills which are universal across languages. Based on these two levels, I would like to propose the following five fundamental dimensions to be incorporated in L2 inference research :

1) Identification of inference types
2) Automatization of the process and assessment methodologies
3) Background knowledge
4) L2 proficiency
5) L1 reading transferability

1), 2) and 3) represent universal aspects to inference study regardless of whether the target language is L1 or L2. 4) and 5) indicate the unique aspects exclusively for L2 reading research.

Although acquiring a comprehensive picture of studies developed in L1 reading and applying some useful ideas to L2 reading will provide L2 reading research with more effective insights, failure to consider some of the inherent characteristics uniquely belonging to L2 reading will lead to a misconstruction of complex mechanisms unique to L2 reading. Similarly, failure to consider the universal cognitive mechanism which largely constructs L2 reading ability will leave L2 reading research in its infancy at theoretical base.

2.0. Inference Types

The first dimension which should be incorporated in L2 inference analysis is identification of the target inference type. As mentioned above, there is no consensus especially in ESL literature about what to refer to as inference and how to

classify inference types. Unlike L1 reading research, only few attempts have been made on classifying and specifying of inference types and the concept 'inference' has been used inconsistently in L2 reading. In schema-theoretic view, for example, inference often refers to a process of guessing states and predicting consequences (Cf. Temma 1989, Shimada 1992). In Hammadou (1991) and MacCagg (1984), on the other hand, this term "inference" refers to the process which provides whatever information is implicitly stated in the text.

However, a common theoretical ground is required in L2 inference research, in order to specify the target inference type, otherwise the findings in the research do not allow any valid generalization about inference process. Consequently the L2 inference research is in need of reconsideration of what process the term 'inference' should refer to, in order to establish a full-fledged theoretical framework by which inference types can be validly classified and target inference can be specified.

As suggested in Vonk & Noodman (1991) and Chikalanga (1991), there are two confounding issues which should be treated separately when discussing inference types: text representation and deductivity of the inference.

The first issue, 'text representation', refers to what information the inference contributes to the representation of the text. One way of classifying inference types is to establish a framework which provides text analysis procedures based on the theory of text structure developed in text linguistics, so that the findings will clarify how comprehenders' inference contributes to text elaboration (cf. Meyers 1975, Kintch and van Dijk 1978, Sanders et al. 1992, Knott & Dale 1994, Mann & Thompson 1987 for expository text; Trabasso et al. 1989, Mandler & Johnson 1977, Meyers 1990 for narrative text). Attempts were made by Graesser & Kreuz (1994) and Chikalanga (1991) to propose a comprehensive taxonomy of inference based on what kind of information can be contributed to text representation by making the inference (see Table 1 and 2).

Another attempt was also made in MacCagg (1984) to categorize inference propositions in L2 / L1 comprehenders' summary recall into rethorical patterns based on a modified framework of Meyer's and Kintch's (see Table 3). Theses classifications may not be exhaustive but address important distinctions in a discourse analysis.

These text-analytic point of views, however, fail to identify criteria related to psychological processes in the readers. They just classify inferences with respect to their function in the text. At the outset, consequently, the issue of reasoning difficulty should be distinguished from the issue of text analysis.

The second dimension, deductibity, refers to the extent to which inferences are authorized by the text, in other words, whether inferences are valid deductions from the text or not. As mentioned earlier, in L1 reading research, a distinction is frequently made between inferences that are necessary for comprehension (i.e. bridging inference) and ones that are not necessary (i.e. elaborative inference). In Graesser & Kreuze (1994)'s classification in Table 1, for example, pronominal resolution, causal antecedent are the inference types necessary for establishment of coherence, and main theme and author's intent are inferences types which are not necessary for comprehension but simply represent an elaboration. The taxonomy suggested by Chikalanga (1991) in Table 2 is also based on the perspective of reasoning difficulty as well as the text-analytic perspective. Depending on whether inferences can be logically derived from the text (textually driven) or they are largely based on the information outside of what is explicitly stated in a text (scripturally driven), the reasoning difficulty varies (cf. Peason & Johnson 1978).

As shown above, the two confounding issues, text representation and deductivity should unfailingly be separated, in order to provide full picture of inference types. Once a full-fledged classification of inference is made, target inference type should be specified based on these perspec-

tive so that more precise observation will be made by controlling possible factors.

2.1. Automatization of the Process and Assessment Methodologies

Another most essential dimension to L2 inference analysis is at which level the target inference is generated and what methodology is the most appropriate for assessing the inference process. According to the literature on L1 reading, inferences can be generated at two activation level: on-line level where inferences are spontaneously and automatically generated during reading; off-line level where inferences are generated or induced by retrieval tasks such as inserted cues and questions. The ability to be able to infer some information spontaneously is one thing and the ability to be able to give appropriate responses to questions or cues is quite another. The inference research, therefore, should be sensitive to this distinction and the assessment methodology should be designed based on the level at which the inference is generated.

Most of L1 inference studies in cognitive psychology have been concentrating on investigating on-line inference and attempting to answer whether or not a class of inference is generated on-line. Behavioral measure such as memory measure (e.g. recall), reading measure (e.g. reading time) and on-line latency (e.g. word recognition) is often used and other types of measure, such as verbal protocol which reveals potential on-line inferences is sometimes combined with a behavioral measure as a multiple methodology, in order to avoid enforcing destructive tasks which may cause superficial processing (Horiba 1993, Magliano & Graesser 1991).

In the L2 reading literature, on the other hand, inference generation has been assessed only in off-line manners at retrieval tasks such as inserted cues and questions. Chikalanga (1991, 1993), for example, designed many types of comprehension questions to assess ESL learners' inference ability based on his taxonomy shown in Table 2. This methodology, however, has offered no direct evidence for their ability to generate inference spontaneously during reading because the inferences assessed by this methodology are not spontaneously generated ones but inferences induced by clues in answering questions. Similarly, in Collins & Tajika (1996), Hammadou (1991) and MacCagg (1984), off-line methodologies were employed such as recall task. Since this kind of off-line measurement is not assessing spontaneous and automatic activation of the inferential process but inducing inference generation by providing various clues or even destructing the natural process.

Even among off-line approaches, however, the activation manner differs depending on the assessment format employed in the study. Written recall and questions in free-response format, for example, encourage more spontaneous generation of inference than questions in a multiple choice format, which tends to force inference generation.

At the outset, consequently, the level of inference-generation has to be specified and the most appropriate methodology should be employed to assess the target inference, in order to provide a more precise picture of inference process.

2.2. Background Knowledge

The third crucial dimension to L2 inference researches is comprehenders' general knowledge about the content of text. It is well established that the readers' general background knowledge plays a crucial role in the understanding of a text. There have been also a considerable number of studies which indicate a high correlation between learners' background knowledge and their reading comprehension (Widowson 1979, Carrell 1981, Carrell & Wallace 1993, Johnson 1981, 1982, Wilson & Anderson 1986). Some of the L2 reading studies suggested that the background knowledge of the reader has a greater effect on L2 comprehension than the level of syntactic and semantic complexity.

The positive effect of background knowledge on inference process has so far been extensively reported in L1 literature (Fincher-Kiefer 1992,

Noordman & Vonk 1992, Chaffin 1979). Some of L2 reading studies have also attempted exploration on relation between L2 inference performance and background knowledge (i.e. Chikalanga 1991, MacCagg 1984). Chikalanga (1991) has shown that lack of appropriate background knowledge may adversely affect not only a reader's ability to deal with elaborative inferences which depend on world knowledge but also the reader's ability to deal with text-constrained inferences. MacCagg (1984) has also concluded that skilled readers outperform less skilled readers in generating appropriate inference but their performance can be matched by less skilled readers if enough background information is provided. This finding in MacCagg (1984) has suggested that sufficient background knowledge allows low L2 proficiency readers to use their store of prior knowledge to overcome inefficient syntactic processing skill and to make comprehension enabling inferences.

From this brief discussion above, it is apparent that there is a positive relation between background knowledge and inference process even in L2 reading. Direct evidence for this positive relation will be needed in L2 reading research at its empirical base.

2.3. L2 Proficiency

The first L2 specific dimension is the constraints imposed by insufficient L2 proficiency on reading comprehension. Not only are they required to read especially highly decontextualized materials but they must have attained adequate L2 linguistic proficiency in order to read in the target language (Alderson 1984, Carrell 1991, Bossers 1991, Brisbois 1995). L2 reading requires L2 linguistic knowledge constructed of such components as orthographic knowledge, vocabulary knowledge, phonologic knowledge, morphosyntactic knowledge, and discourse knowledge (cf. Koda 1994)

Especially high level cognitive skill such as inference-generation demands considerable cognitive resources, without leaving satisfactorily enough resources for processing L2 linguistic properties, unless other components of the reading process are automatized. In other words, inferential ability cannot be validly assessed unless the comprehenders have achieved a level of second language linguistic ability, so-called "the linguistic threshold" (cf. Cummins 1979, Alderson 1984, Bernhardt & Kamil 1995). Consequently it is necessary to consider insufficient linguistic knowledge as one of the most determinative factors which lead to unsuccessful inference generation, by investigating how far the L2 linguistic limitation affects inference process and comparing inference process of high- and low-proficiency L2 learners, as already done in some of the studies (Hammadou 1984, MacCagg 1984, Chikalanga 1992, Horiba 1993).

2.4. L1 Transferability

The next L2 specific dimension to L2 inference research is interlingual reading skill transfer. A number of L1 comprehension studies and L2 acquisition studies have demonstrated that various cognitive and metalinguistic skills are transferred from L1 to other situations posing similar cognitive requirements. In other words, poor reading in a foreign language is due to poor reading ability in the first language, as assumed by "short-circuit hypothesis" or "the linguistic interdependence hypothesis" (Clarke 1980, Alderson 1984, Bernhardt & Kamil 1995). This seems to imply that some L1 skills can be applied to another language. Further support for the likelihood of L1 transferability can be found in studies investigating age difference in the achievement of L2 linguistic competence. These studies demonstrate a high correlation between leaners' age and L2 proficiency.

Assuming that linguistic orientation generated by L1 linguistic features influences the cognitive procedures used in L2 processing, as a considerable number of studies suggest, it seems reasonable to assume that the L1 inference ability can also influence or constrain L2 inference performance. Although some of the L2 inference studies

have demonstrated a positive correlation between L1 inference skill and L2 corresponding skill by comparing L2 readers and L1 readers, no direct evidence for L1 transferability was provided (cf. Horiba 1990, 1993, MacCagg 1984, Chikalanga 1991).

Similarly, scant work has been done on age differences in the achievement of L2 inference ability, while a considerable number of studies have been devoted to investigation of age-related changes in the ability to draw L1 inferences. Chikalanga (1991) is the only work, to the best of knowledge, that has attempted to provide direct evidence for high correlation between a learner's age and L2 inference ability. This finding would seem to suggest existence of a transfer of L1 inferential skill to L2 counterpart.

One way of investigating the effect of L1 inference ability on L2 corresponding performance is to incorporate the perspective of interlanguage cognitive skill transferability in the analysis and to observe the inference behavior of the same subject in both his / her L1 and L2 reading. However it is not possible to discuss this transferability issue without clarifying whether it is L2 proficiency or L1 reading ability that influences L2 inference performance most.

The study also needs to separate the two confounding issues at the theoretical level: age-related change in cognitive skill and L1 reading transferability. In other words, that children show significant improvement on L2 reading as they grow older and their cognitive skills develop as demonstrated in Chikalanga, while L2 inference process might not be influenced by L1 reading ability once certain cognitive ability is acquired.

3. Conclusion

As discussed above, L2 reading research will benefit substantially from a concerted effort: to investigate subcomponent process skill such as inference, from newer perspectives developed in L1 reading theories, and second, to explore the unique comprehension problems encountered by L2 learners. In this sense, the five perspectives discussed above should be incorporated into the analysis of such subcomponent processing skill as inference. I believe making such research endeavors will illuminate new paths to L2 reading development and the research findings will contribute to better methods of L2 reading instruction.

Note

1 There are considerable numbers of work which have concentrated on a particular type of inference. Horiba (1993), for example, has restricted her target inference type to causal inference and demonstrated positive correlation between causality of the text and inference-generation both in L1 and L2. Collins and Tajika (1996) have also focused on a specific inference type which identifies an instrument used in the action expressed by the verb (i.e.instrument inference), and investigated the effect of inference training on L2 learners' reading comprehension. Similarly, exploration of lexical inference has also received growing attention (i.e. guessing ability of unknown word(s) meaning : Kern 1989, Sato 1995).

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Appendix

Table 1:
Graessear & Keruze(1994)' taxonomy of inference type

Anaphoric reference
Causal antecedent
Causal consequence
Instrument
Instantiation of noun category
Superordinate goal
Subordinate goal
Subordinate actions
State
Emotion
Theme
Author's intent

Table 2 :
Chikalanga (1991)'s taxonomy of inference type

Lexical
Pronominal inferences
Ambiguous/unfamiliar word meanings
Propositional
Logical informational
- referential
- spatio-temporal
Logical Explanatory
- motivational
- causative
- enablement
Pragmatic/Scriptal
Elaborative informational
- referential
- spatio-temporal
Elaborative Explanatory
- motivational
- causative
- enablement
Evaluative

Table 3:
MacCagg (1984)'s classification of proposition type

(inference proposition types)
macro appropriate inference
micro appropriate inference
macro inappropriate inference
micro inappropriate inference
(other proposition types)
text based proposition
perspective proposition
evaluative proposition
background knowledge base proposition
ideal summary proposition

Abstract

A major purpose of this article is to examine past research devoted to the 'inferential process' in first language (L1) reading and second language (L2) reading and, in so doing, to uncover significant research voids related to L2 reading research and suggest further research possibilities. The article first demonstrates current development on inference study in both L1 and L2 reading research. It then discusses five fundamental dimensions to L2 inference research from the perspectives of cognitive process required in reading and unique problems encountered by L2 reading research. The five fundamental dimensions discussed here are: 1) types of inference 2) automatization of the process and assessment methodologies 3) the effect of background knowledge 4) the effect of L2 proficiency 5) the transferability of L1 reading skill. This article also proposes how these five dimensions should be incorporated in the L2 inference research, in order to establish adequate theoretical ground for L2 reading research.